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afraid that in the past a great deal of teaching power has undoubtedly been wasted; or sometimes even that the would-be teacher's latent teaching power has never been developed, or not till after many years of vain experiments, with the natural result that his would-be pupils have not been really taught. But I believe, too, and will ask you to believe, that this waste of power is less now than at any previous period of this century, thanks chiefly to the present wide-spread revival of interest in education, an interest of which the very existence of this great society, still more its rapid growth, is an amazing proof. And I believe that in the not far distant future such failures will become still more unfrequent if it can be secured, as many of us hope it shortly will, that all would-be secondary teachers before embarking on the office of schoolmaster shall—over and above their general education—undergo some special training in the art of teaching.

EYESIGHT IN CHILDREN.

By G. B. Batten, M.D.

All around us in the universe are certain forces and certain forms of matter. We know about these only by impressions received through our various senses and carried by the nerves of sensation to our brains. There may be, nay, surely there must be forces and forms of matter in the universe of which we know nothing, simply because we have no sense organs by which we can receive impressions from them.

The eye is the organ by which we receive impressions of light, some of it coming possibly from a few inches from us, some of it from stars billions of miles away.

Now, what is light? Light is a form of radiant energy which travels through the luminiferous ether in the form of very small waves, the waves being at right angles to the line in which they travel; so although thirty years ago, that brilliant genius, Professor Clarke Maxwell, prophesied that all forms of radiant energy would be found to be magneto-electrical perturbations of the ether, it was not until the last few years that we knew of the existence of any other forms of radiant except heat, light and actinic or chemical energy. We are now able by electrical and other means to make out all sorts of forms of radiant energy of all sorts of wave lengths, from the huge magneto-electrical waves received from the sun, which are hundreds of miles long, up to smaller and smaller electrical waves right up to the smallest we have as yet perceived electrically—about $\frac{1}{4}$-inch long; through a gap where there are waves which we know nothing about, up to the largest kind of heat waves, which are, however, not quite $\frac{1}{1000}$-inch long; through smaller heat waves, up to the various kinds of light waves, from the longest or red ones through smaller actinic or chemical energy waves, on which photographers chiefly rely, up through another gap to the mysterious and probably infinitesimally small waves called "X" rays, which have such wonderful penetrative powers.

Now all these forms of radiant energy, from the largest electro-magnetic to the smallest light ones, which have been measured, all travel at the same rate, namely, 300,000 kilometres or 186,000 miles per second. The shorter the waves therefore the more often must they oscillate. These very large electro-magnetic ones only oscillate 512 times per second; these small actinic ones, 1,125 billions (1,125,000,000,000,000) times per second.

The human eye, wonderful organ as it is, is only attuned to receive and can only, perhaps luckily for us, receive impressions from the comparatively small range of waves that are called light. They all occur as you see in the forty-ninth octave, and vary from $\frac{1}{33,000}$ of an inch for longest red rays, which oscillate 451 billions of times (451,000,000,000,000) per second, to the smallest violet rays $\frac{1}{67\,000}$ of an inch, which oscillate 789 billions of times (789,000,000,000,000) per second.

Our skins and various forms of heat-measurers, as thermometers, can perceive longer waves below the red, and photographic plates can be affected by shorter waves above the violet, but our human eyes can only perceive waves of light—red to violet.

It is possible that other animals, as perhaps insects, can discern other wave lengths, other colours so to speak, but our eyes cannot.

Light travels in straight lines, but we can by suitable devices alter the directions in which these light rays travel—they are reflected, refracted and transmitted; reflected from the surface of all substances not perfectly transparent, as from flowers, leaves, and in fact everything that we can see, they are transmitted or partially transmitted or go through all transparent substances as water, glass, etc. They are refracted or bent by passing obliquely through all transparent substances which are denser or heavier than medium in which they have been travelling, as for instance, when passing through a prism of glass from air, a ray of light going into a prism is bent towards thicker part of the prism. Put two prisms base to base $\overset{\wedge}{\vee}$ () and we have practically a convex lens or magnifying glass, and with this we can bend the rays of light coming from any object or sets of objects so that we can get an image or picture of such objects. Thus we have the photographic camera, which consists chiefly of two parts, a lens or bender of light rays which forms an image, and the photographic plate on which the image falls. In a camera also we have a focusser to make the image fall accurately on sensitive plates, and also "stops" so as not to admit more light than is wanted.

The human eye is practically a camera. It consists of various refracting media, all denser than air, and which are the clear plate-glass looking cornea, the aqueous humour, the crystalline lens and the vitreous humour; and then all round the back and muscle of the eye we have the sensitive retina on which the images formed by the focussed light waves fall. This retina is a very delicate membrane made up of hundreds of thousands of rods and cones which are really the terminations of the optic nerve which transmit sensation produced by the light images to the brain, the brain understands these nerve impulses and we see. In the eye also is a focussing apparatus which allows us to adapt the eye so as to look clearly either at near or distant objects whenever we wish. This is managed by little muscles which allow crystalline lens to become flatter or more spherical, *i.e.*, weaker or stronger. This power of focussing is called our power of accommodation, and please remember that it is done by little muscles. Then we have the beautifully coloured iris, which is around the pupil or central path of light and which allows more or less light to get in as required to the sensitive retina. The iris is also a muscle or rather set of muscles which alter size of pupil, making it larger or smaller—smaller when looking at a bright object or bright light, to prevent sensitive retina from being injured—and larger in a dim light, so as to utilize as much light as we can get. Now having these optical instruments, our eyes, how do we use them? A newly-born infant is not blind exactly, but it cannot see, because it does not know how at first, but it soon learns. Now let us consider what it has to learn: anatomically the eye of an infant is perfect, and so any light falling on its eyes is transmitted to its retina and produces some impression no doubt, but to see properly an infant has to learn the following things:—

(1) To turn the eyes so as to look at what it wants to see.

(2) To so turn each eye that image from any object falls on corresponding portions of retinæ of both eyes, *i.e.*, to learn to converge eyes properly on objects near it.

(3) It has to learn to accommodate, *i.e.*, to arrange its lenses so as to *focus* rays properly on the retinæ: so that image on retina is sharp and clear and not blurred.

(4) Then the brain has to learn by experience what the images on retinæ represent, of what objects the images are, their size, their distance away, their colour, etc.

I well remember a case which was partly under my care in the ophthalmic wards in the Royal Edinburgh Infirmary. This was a child about eight years old, who had been blind from birth from presence of congenital cataract or opacity of her crystalline lenses, she had a perception of light and darkness but that was all, but she was quite intelligent and knew what things were by feeling them. Well, she was operated on, and the opaque lenses—the cataracts—removed, and proper spectacles (to make up for the lenses) used, and she could see. But how imperfectly! She had to learn what the things she saw were; for instance, if one held an orange up and asked her what it was, she did not know, but said it was a round-shaped thing; she had not the least idea how far off it was; she would put her hand out for it, equally, if it was one foot or twenty feet from her. Then we let her feel it, and she called out at once, "Oh! it's an orange." It was a most interesting and pleasant employment for doctors, nurses, and patients, to teach this child to see, and watch her delight in seeing and learning to recognise by her sight objects which she previously only knew by touch; she quickly learnt. Before, however, she had done so, she was out on a balcony about fifteen feet from the ground outside, and seeing the grass lawn below, and not a bit knowing how far off it was, she asked another patient, an adult whose eyes were quite covered up, to lift her over the railings; this was done, and the child, of course, fell fifteen feet on to the grass, but luckily was not hurt, and was found some little time afterwards by a nurse contentedly picking daisies on the lawn below.

(*To be continued.*)

ON THE LIZARD DOWN.

By Mrs. Dorman.

The heath is almost as flat as a table, not a tree, scarcely a bush, breaks its uniformity for miles, and as landmarks to guide the traveller are few and far between, a pocket compass is almost a necessity, as distant objects have a most unaccountable way of shifting their position and thus bewildering the stranger. The low blue distant hills are some twenty or thirty miles away in the Land's End peninsula, and the faint line of cliffs still further to westward, that melts into both sea and sky, has for its termination Tol-pedn-penwith (the holed headland), and the great pillar rock of lichened granite that used to be called Land's End; but Land's End proper is not visible from the Lizard. Much nearer is Rill Head, and below it, scarcely a mile away, the famous "Lion" of Kynance Cove heaves his great rounded back landwards as he lies couchant in the sea, guarding, as does many another Cornish Lion, this wild west coast of England. *Meneage*, the stony-land, was the ancient name of the Lizard peninsula, which is almost cut off from the county of Cornwall by two rivers flowing in opposite directions; and crossing Helford river from the direction of Falmouth, such names as "St. Anthony in Meneage," "St. Mawgan in Meneage," tell that we have entered the Lizard district beloved of botanists; for though many parts, especially on the serpentine, are barren enough in the ordinary sense, the vegetation on the slate and basaltic formation of its eastern side is comparatively luxuriant, and trees flourish in the sheltered valleys; while fuchsias, escallonias, the tender climbing plants that overhang the thatched cottages, and the great yellow-flowered mesembryanthemum that drops perfect sheets of succulent verdure down every rock where a stray plant has taken root, bear testimony to the mildness of the climate. The Tamarisk here attains a good size, and a very quaint and pretty tree it makes with its twisted gnarled stems and vapoury foliage.

There are some plants peculiar to the Lizard district, good "finds" that are not met with elsewhere, and many